Notes:
1. Untranslatable words are replaced with asterisks (****).
2. Texts in the figures are not translated and shown as it is.

Translated: 08:09:32 JST 12/17/2009
Dictionary: Last updated 12/14/2009 / Priority: 1. Electronic engineering / 2. Chemistry / 3. Mathematics/Physics

CLAIM + DETAILED DESCRIPTION

[Claim(s)]

[Claim 1][by dissolving used oxide atom fuel in fused salt and/or liquid cadmium, and electrolyzing fused salt] A reprocessing method of spent reactor fuel characterized by using a mixture of fluoride salt and chloride salt as the above-mentioned fused salt in a reprocessing method of spent reactor fuel which collects uranium and/or plutonium to solid cathode and/or the cadmium cathode from a component of the above-mentioned dissolved spent reactor fuel.

[Claim 2][by dissolving used metallic fuel or/and used oxide atom fuel in fused salt and/or liquid cadmium, and electrolyzing fused salt] In a reprocessing method of spent reactor fuel which collects uranium and/or plutonium from a component of the above-mentioned dissolved spent reactor fuel to solid cathode and/or the cadmium cathode, When using a mixture of chloride salt, or a mixture of a chloride and a fluoride as the above-mentioned fused salt, An operating method of a rework device recovering recovering efficiency by adding fluoride salt to fused salt when oxygen and/or water mix in fused salt and recovering efficiency of uranium and/or plutonium falls.

[Claim 3]A reprocessing method of spent reactor fuel using a mixture which contains a mixed salt ghost of eutectic composition of lithium chloride and potassium chloride in Claim 1 or 2.

[Claim 4]A reprocessing method of spent reactor fuel using fluoride salt which contains at least one kind of same ion as a metal ion of chloride salt in Claim 1, and 2 or 3.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention is concerned with the method of collecting uranium and/or plutonium from the mixture which uses as the main ingredients the uranium which contains a fission product like used nuclear fuel, for example, and plutonium, Especially, used oxide fuel

uranium and/or plutonium to the inside of fused salt are dissolved, and it is related with a suitable method to collect used oxide atom fuel uranium and/or plutonium by electrolysis.
[0002]
[Description of the Prior Art][the method of dissolving and collecting uranium and/or plutonium to the inside of fused salt] For example, if used metallic fuel is dissolved in liquid cadmium, the above-mentioned liquid cadmium is used as an anode and solid cathode or another liquid cadmium is energized as the cathode as stated to JP,4-319699,A, The lanthanum, curium, zirconium, uranium, and plutonium which become a chloride easily oxidize, and move to the inside of a molten chloride, for example, potassium chloride lithium chloride. By adjusting the potential of the cathode at this time, uranium and/or plutonium to a chloride in which easy is comparatively small can be deposited on the cathode among the elements which move into fused salt.
[0003]Another method of dissolving and collecting uranium and/or plutonium into fused salt is stated to JP,6-324189,A. By making electropositive potential energize so that a melting metallic phase may serve as electronegative potential, the used metallic fuel installed among the molten chloride without potassium chloride lithium chloride oxidizes electrically, and dissolves used metallic fuel as a chloride into a fused salt phase. It is returned by a melting metallic phase and lanthanum, curium, zirconium, uranium, plutonium, etc. in fused salt dissolve in a melting metallic phase by a metallic state. By installing solid cathode in a fused salt phase so that it may act as the cathode to a melting metallic phase, the substance which becomes a chloride easily, for example, uranium and plutonium, oxidizes, and they shift to a fused salt phase from a melting metallic phase. It is returned alternatively, and uranium in which easy [to a chloride] is comparatively small among the elements in a fused salt phase, zirconium, etc. are deposited and grown up, and are collected in a solid cathode side.
[0004][how oxide fuel is dissolved in fused salt and electrolysis recovers uranium] For example, "fused salt and high-temperature-chemistry" Electrochemistry Sub-Division association It is described by 248 pages of the Molten Salt Committee issue, and 16 pages of "chemical engineering of fuel-reprocessing and waste management" Nikkan Kogyo Shimbun issue by two persons besides M.Benedict. Used oxide fuel is dissolved into a molten chloride, supplying gaseous chlorine or hydrogen chloride gas into a molten chloride, for example, sodium chloride potassium chloride. If it energizes so that the solid electrode which a reaction vessel installs into an anode and fused salt may turn into the cathode with a reduction state, it will be returned on the solid cathode surface, and uranium in which easy [to a chloride] is comparatively small will be deposited and collected. By raising the oxygen ion concentration in fused salt, plutonium is recoverable as precipitation.
[0005]By returning used oxide fuel to metal, the method of collecting uranium and/or plutonium using fused salt is also considered (95-year American Nuclear Society, the annual convention

J38, Aso et al.).

[0006]

[Problem to be solved by the invention]Chloride salt is used for conventional technology as fused salt in order to use the difference in the ease of becoming for each chloride of uranium, plutonium, and a fission product. However, since uranium, plutonium, and a fission product will constitute an oxide and will not dissolve in fused salt, if oxygen or/and water mix in fused salt or liquid cadmium at the time of the above-mentioned electrolysis, Even if it electrolyzes, SUBJECT of it becoming impossible to deposit uranium and/or plutonium on the cathode occurs. In order to use chloride salt as fused salt and to dissolve the fuel which contains uranium etc. as an oxide in fused salt, gaseous chlorine and/or hydrogen chloride gas are supplied into fused salt, or SUBJECT that oxide fuel must once be returned to metal also occurs.

[0007]

[Means for solving problem]Since above-mentioned SUBJECT is solvable if an oxide is dissolved in chloride fused salt, the fused salt which added the fluoride is used for a chloride in this invention.

[0008]In order for an oxide to dissolve in fused salt, in the case of a uranium oxide, uranium and oxygen must ionize, for example, and each must dissolve in fused salt. However, since the ionized oxygen, for example, the capability to dissolve oxide ion, is very low, the chloride fused salt cannot dissolve oxides, such as uranium. On the other hand, the fused salt of a fluoride has the high capability to dissolve the ionized oxygen. Therefore, if fluoride salt is added to chloride fused salt, oxides, such as uranium, will dissociate to metal ions, such as uranium, and the ion of oxygen, and will dissolve in fluoride fused salt. Since metal ions, such as uranium, are movable to chloride fused salt from fluoride fused salt, When oxygen or/and water mix in fused salt, and even when reworking oxide fuel, these ion can be made to exist in fused salt, and recovery of uranium and/or plutonium is attained by electrolysis.

[0009]

[Mode for carrying out the invention]

(Embodiment 1) It explains using drawing 1 below per embodiment of this invention. Drawing 1 is a used oxide atom fuel-reprocessing device by the fused salt electrolysis to which this invention is applied. The fused salt 4 which contains the oxide fuel 2, the liquid metal cadmium 3 and fluoride salt, and chloride salt in the electrolytic cell 1 is loaded. A melting point is low preferred when the chloride of eutectic composition of lithium chloride and potassium chloride is used at this time. When using only a chloride as fused salt, since the ionized oxygen, for example, the capability to dissolve oxide ion, is very low, the chloride fused salt cannot dissolve oxides, such as uranium. On the other hand, since fluoride fused salt has the character to dissolve the ion of oxygen, the oxide of the element which becomes the uranium

oxide, plutonium oxide, and chloride in oxide fuel easily is dissociated to a metal ion and the ion of oxygen, and dissolves in fused salt. Subsequently, if the cathode 5 is immersed in fused salt, the anode 6 is immersed in metallic cadmium and it electrolyzes according to the direct current power supply 7, it will be returned by the cathode and uranium in fused salt and/or the metal ion of plutonium will produce the deposit 8. The ease of becoming can choose and deposit only comparatively small uranium and/or plutonium in a chloride by adjusting cathode potential at this time. according to this example, it can be alike by electrolyzing used oxide atom fuel in fused salt, and uranium and/or plutonium can be collected alternatively.

[0010](Embodiment 2) It explains using drawing 2 below per another embodiment of this invention. Drawing 2 is a rework device of the used oxide fuel by the fused salt electrolysis to which this invention is applied. It has the oxide fuel 2, the fluoride salt fused salt 13, and the chloride salt fused salt 14 in the electrolytic cell 1. A melting point is low preferred when the chloride of eutectic composition of lithium chloride and potassium chloride is used at this time. If what has specific gravity lighter than chloride salt is chosen as fluoride salt, chloride fused salt and fluoride fused salt will be separated up and down.

[0011]Used oxide fuel is loaded in the basket 15 which served as the anode, and it is immersed into the fluoride fused salt 13. Subsequently, the solid cathode 16 is immersed into the chloride fused salt 14. Used oxide fuel dissolves into the fluoride fused salt 13, and ion, such as uranium and plutonium, moves to chloride salt from fluoride salt further. If it electrolyzes according to the direct current power supply 7, it will be returned by the cathode and uranium and/or the plutonium ion in the molten chloride salt 14 will produce the deposit 8. At this time, the ease of becoming can choose and deposit only comparatively small uranium and/or plutonium in a chloride by adjusting cathode potential.

[0012]When ion, such as uranium, shifts to chloride salt from fluoride salt, some metal ions in chloride salt need to shift to fluoride salt. Since the potential control of the cathode will become difficult if composition change of fluoride salt starts by this shift, it is preferred to use the fluoride salt containing at least one kind of same ion as the metal ion of chloride salt.

[0013](Embodiment 3) It explains using drawing 3 below per another embodiment of this invention. Drawing 3 is a used metal atom fuel-reprocessing device by the fused salt electrolysis to which this invention is applied. The metallic fuel 9, the liquid metal cadmium 3, and the fused salt 10 of chloride salt are loaded into the electrolytic cell 1. A melting point is low preferred when the chloride of eutectic composition of lithium chloride and potassium chloride is used at this time. The metal of uranium in used metal atom fuel, plutonium, and a fission product dissolves in liquid cadmium, and serves as a liquid alloy. If cadmium chloride is added to fused salt, cadmium chloride will be converted into the chloride of each metal by the difference in the ease of becoming at metal, and uranium, plutonium, lanthanum, curium, zirconium, etc. will shift into chloride fused salt. Subsequently, if the cathode 5 is immersed in

fused salt, the anode 6 is immersed in metallic cadmium and it electrolyzes according to the direct current power supply 7, it will be returned by the cathode and uranium in fused salt and/or the metal ion of plutonium will produce the deposit 8. However, when the sealing nature of an electrolytic cell is insufficient and oxygen or/and water carry out ** ON into an electrolytic cell, uranium, plutonium, lanthanum, curium, zirconium, etc. form an oxide, and, and recovery by electrolysis becomes impossible [zirconium]. [fused salt] In this invention, the fluoride salt feeder 11 is formed, and when precipitation arises, the fluoride salt 12 is supplied to an electrolytic cell. The oxide of the element which becomes the uranium oxide, plutonium oxide, and chloride which had precipitated easily dissolves in the fused salt which dissociates to a metal ion and the ion of oxygen and contains fluoride salt again. Uranium and/or plutonium recovery operation by electrolysis are recoverable by this remelting. According to this example, recovery of uranium by fused salt electrolysis of used metal atom fuel and/or plutonium can recover recovery operation, when oxygen or/and water are blocked by the ** ON into an electrolytic cell.

[0014]In this example, when oxygen or/and water carried out ** ON into an electrolytic cell and electrolysis recovery operation stopped, fluoride salt was added, but disturbance by ** ON into oxygen or/and an electrolytic cell of water may be prevented by adding fluoride salt to fused salt beforehand.

[0015]

[Effect of the Invention]According to this invention, it is possible to dissolve used oxide fuel into fused salt, without adding gaseous chlorine, hydrogen chloride gas, etc. in any way by adding fluoride salt to chloride salt. Therefore, reprocessing of spent fuel can be performed under the atmosphere in which oxygen exists (for example, the inside of the atmosphere). Since the handling of corrosive gas, such as atmosphere adjustment by the argon gas needed by the reprocessing-of-spent-fuel method using the conventional fused salt, gaseous chlorine, hydrogen chloride gas, becomes unnecessary by this, it is possible to reduce the cost concerning a reprocessing facility.

[0016]According to the invention of Claim 2, when electrolyzing used metal atom fuel in fused salt and collecting uranium and/or plutonium alternatively, recovery operation can be recovered from disturbance by the ** ON into oxygen or/and the electrolytic cell of water, or the above-mentioned disturbance can be prevented.

[0017]According to the invention of Claim 3, since the eutectic temperature of fused salt is comparatively low and the operation temperatures which perform reprocessing are lowered, the corrosion of a reaction vessel is pressed down and the yield of waste can be reduced.

[0018]According to the invention of Claim 4, since there is no composition change of fused salt when the ion which dissolved in fluoride salt shifts to a chloride, stable potential control can be performed.

[0019]according to this invention, although it can be alike by electrolyzing used oxide atom fuel in fused salt and uranium and/or plutonium can be collected alternatively, it can do.

[Translation done.]